Will Government Subsidies Increase Investor Confidence in Listed Agricultural Companies?

Linlin Guo[a] and Panpan Yang[b]
Zhengzhou University of Aeronautics, Zhengzhou, Henan Province, China

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Abstract: Financial fraud cases of agricultural listed companies have occurred frequently, adversely affecting investor confidence. By using the big data method, this paper develops the agricultural IC index and analyzes the impact of different types of government subsidies and tax refunds on the IC of agricultural listed companies from the perspective of behavioral finance.

1 INTRODUCTION

Agricultural listed companies are at high risk of financial infidelity and fraud. According to the Choice of Orient Wealth, from January 2010 to December 2020, a total of 312 listed companies in China's A-share market were subject to public sanctions or regulatory investigations for disclosing false information, including 54 agricultural enterprises (agriculture, forestry, animal husbandry, fishery, and agricultural product processing), accounting for about 17% of the A-share market in China. Poor quality disclosure of information of agricultural listed companies will cause investors to worry about possible losses, which seriously undermines investor confidence (IC) and creates a risk of a decline in the valuation of agricultural listed companies or an increase in financing capital. On this basis, this paper develops an agricultural IC index with the big data method, and studies whether the subsidies and supports of the government have a supportive effect on the investors of agricultural listed companies from the perspective of behavioral finance, and further examines the possibility of increasing IC in the information disclosure of agricultural enterprises and government supports easily affecting IC.

2 LITERATURE REVIEW

In order to study whether government subsidies have a supportive effect on the agricultural IC, it is important to first obtain the agricultural IC. The traditional method is to obtain IC through investigation. Today, Internet data records the micro-psychological information and concerns in searching of investors and provides massive data for research. Web text data mining and its application in the economic and financial fields were developed in foreign countries early on. Ettridge et al. (Ettridge, et al, 2005) were the first to propose that web search data have an important value in economic statistical research. In studying assets pricing. Iresberger (Iresberger, 2015) used the search engine Google to collect network data representing the crisis psychology of investors. Zongyue et al. (Zongyue, et al., 2017) conducted an emotion analysis based on the received domestic financial news comments, expanded the emotion dictionary by using the clustering method for the news comments, combined with the time characteristics of the text, and decided to assess the emotional tendency of the text with the help of machine learning. Zhang. Zongxin et al. (Zhang, 2021) conducted an emotion analysis of the media reporting corpus of individual stocks in Baidu News, used machine learning to classify text emotions and develop the emotion value, and studied the influence of the emotion value of media on the

[a] https://orcid.org/0000-0002-9189-9554
[b] https://orcid.org/ 0000-0001-5874-7885

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securities market. In this paper, it is believed that IC is highly flexible and diverse. Compared with the traditional questionnaire interview method, the IC collection method based on big data technology is more timely and complete.

3 RESEARCH DESIGN

3.1 Variable Design

1) Investor confidence. The level of investor confidence (IC) can reflect the optimism of the market towards agricultural enterprises. This paper uses web crawler technology to obtain web text data of investor exchanges on the Stock Bar Forum of Orient Wealth (China's first financial website with an average daily visitors of over 30 million users), extract the subjects of the text data using the LDA model, and use machine learning algorithms to classify investors' bearish and bullish expectations. Finally, this paper uses the classified emotion value and the quantified feature word weights to develop the Stock Bar investors' bearish and bullish expectation index, of which, combined with Baidu search confidence index and stock turnover rate, will be used to construct the final IC index using principal component analysis. The specific methods are as follows.

First of all, the Python crawler software was used, and the hot post page of Orient Wealth Finance and Economics Review Bar (Stock Bar) was considered as the entry page. The basic information crawled includes page information, post title, publication time, number of comments, page views, and comment contents, and the crawled information was stored by date to form the web text database of the Stock Bar with a certain scale.

Secondly, the text data was processed by cleaning and standardizing the initial Stock Bar comment text data, which was then vectorized using the vector space model. Assume the web text as Q $(k_1D_1, k_2D_2 \ldots, k_iD_i)$, D_i as the feature word of Text Q, and k_i as the weight of the feature word, the feature value of each text was determined using the information gain algorithm, and the cosine value of the angle between vectors was used to indicate the similarity between Text Q. Then, the LDA subject extraction model was used to extract the subject information representing the emotional intensity of investors from the text data set, and it was represented by simplified text. Finally, machine learning classification technology was used to calculate the emotional tendency value of the text data.

Thirdly, the development of the bearish and bullish expectation index of investors of the Stock Bar. The text emotion value was represented by the product of the emotional tendency value of the bearish and bullish of each subject and the sum of the feature words weights, and then the expectation values of all the texts were summed to obtain the expectation values of investors of the Stock Bar for that day. The expectation index was developed according to the following formula.

$$Estock = \sum_{m=1}^{M}\left(sent_m \sum_{k=1}^{K} Temperature(T_{mk})\right) \quad (1)$$

In which, $M=\{1, 2, \ldots, M\}$ represents the number of daily text comment subjects of the Stock Bar, $sent_m$ represents the bearish and bullish expectation value of the M-th subject, and $\sum_{k=1}^{K} Temperature(T_{ck})$ represents the sum of feature words weights in M subjects.

The TF-IDF model was used to calculate the weight of each feature word. Assume TF_{ij} as the frequency of Feature Word D_i in Document Q_i, IDF_i as the inverse text frequency of Feature Word D_i in Document Q_i, and n_i as the number of training samples of D_i, the calculation formula of the weight of the feature value is as follows.

$$Temperature(T_{ck}) = TF_{ij} \times IDF_i = \left(\log\left(freq_{ij}\right) + 1\right) \times \log(n/n_i) \quad (2)$$

In conclusion, the Stock Bar agricultural stock investors' bearish and bullish expectations index can be expressed as:

$$Estock = \sum_{m=1}^{M}\left(sent_m \sum_{k=1}^{K}\left(\log\left(freq_{ij}\right) + 1\right) \times \log(n/n_i)\right) \quad (3)$$

Fourthly, the development of the IC index. The bearish and bullish expectation index of investors of the Stock Bar (Estock), Baidu search index (BIX), and stock turnover (STM) were fitted by principal component analysis method to develop an IC index. For the Baidu search index, the monthly Baidu search volume of the stock code of agricultural listed companies was used instead of the search volume of the company name. Because the company name can be divided into abbreviations and full name, it is impossible to determine which name investors used. In addition, the company name may be searched on Baidu for different purposes. The investors may not search the company name because they care about the stock of the company, but the company's stock code is searched, and can directly indicate that investors actively search and pay attention to the stock of the company

In the principal component analysis, the following standard was strictly complied with to select the information which could ensure the explanation of principal components and all the indexes. The

cumulative variance contribution rate reaches over 85%, and therefore, the first two principal components were selected, and the weighted average was obtained according to the variance contribution rate. The weight was the ratio of the variance contribution rate of the principal component to the sum of the variance contribution rates of the three principal components, and the final result was as follows.

IC=0.6928×Estock+0.6003×BIX+0.5221×STM (4)

2) Government subsidies and tax refunds. The government will support the development of agricultural enterprises through various supporting policies (such as government subsidies, tax incentives, and direct investment). Combined with relevant data on agricultural listed companies, this paper mainly considers two kinds of government support, that is, government subsidies and tax refunds. For government subsidies, according to the provisions of Accounting Standards for Business Enterprises No.16-Government Subsidies promulgated in 2017, this paper sets GOVNOI, the ratio of government subsidies included in non-operating income to operating income, to measure the government's non-operational subsidies to agricultural enterprises, and GOVOI, the ratio of government subsidies included in other income to operating income, to measure the government operational subsidies to agricultural enterprises. As for tax refunds, in order to support the development of agricultural enterprises, the government will give subsidies in the form of tax refunds. This paper sets GOVTR, the ratio of tax refunds to operating income, to measure the tax refunds received by agricultural enterprises.

3) Moderating variables. From the perspective of corporate governance, government support is affected by internal governance and third party supervision. this paper sets GOVEI as the moderating variable to measure the shareholding ratio of state-owned capital investment in agricultural enterprises. A high shareholding ratio indicates that state-owned capital has a strong motivation to participate, which may increase the supervision of agricultural enterprises and the supporting effect of government support.

4) Control variables. Control variables mainly include enterprise size (Size), enterprise profitability (ROE), enterprise financial leverage (LEV), listing age (Age), stock return (SR), dummy variable of the year (Year), and dummy variable of the sector (Sector). If it belongs to the Beijing Stock Exchange, the value is 1, otherwise it is 0.

3.2 Model Design

In order to examine whether government subsidies and tax refunds can increase IC in agricultural listed companies, this paper sets up a double fixed-effect model of individuals and time points based on the data obtained.

$$IC_{i,t} = \beta_1 GOVNOI_{i,t} + \beta_2 GOVOI_{i,t} + \beta_3 GOVTR_{i,t} + \beta_4 Size_{i,t} + \beta_5 ROE_{i,t} + \beta_6 Age_{i,t} + \beta_7 Age_{i,t} + \beta_6 SR_{i,t} + \beta_7 Sector_{i,t} + \beta_i + \theta_i + \varepsilon \quad (5)$$

Where β_i is the fixed effect of an individual, θ_i is the fixed effect of a time point, and the other variables have been introduced in the preceding part of this paper. In addition, from the perspective of corporate governance, we explored whether state-owned capital shareholding and audit supervision improved or worsened the relationship between government subsidies and IC. In Model (2), the moderating variables state-owned capital shareholding ratio were added to test.

$$IC_{i,t} = \beta_1 GOVNOI_{i,t} + \beta_2 GOVOI_{i,t} + \beta_3 GOVTR_{i,t} + \alpha_{i,t} GOV_{SUB_{i,t}} \times GOVEI_{i,t} + \beta_4 Size_{i,t} + \beta_5 ROE_{i,t} + \beta_6 Age_{i,t} + \beta_7 Age_{i,t} + \beta_6 SR_{i,t} + \beta_7 Sector_{i,t} + \beta_i + \theta_i + \varepsilon \quad (6)$$

Where $GOV\_SUB_{i,t}$ is the vector consisting of government subsidies GOVNOI and GOVOI, and tax refund GOVTR; β_i is the fixed effect of an individual; θ_i is the fixed effect of a time point.

3.3 Data Sources

The data studied in this paper is from agricultural enterprises listed on the Shanghai Stock Exchange, Shenzhen Stock Exchange, and Beijing Stock Exchange (the former National Equities Exchange and Quotations selected layer and innovative layer) from 2015 to 2020. A total of 1,432 agricultural listed companies in the agriculture, forestry, animal husbandry, and fishery industries were collected from the Shanghai and Shenzhen Stock Exchanges, excluding alcohol, ST, and samples with less than 3 years of listing. At the same time, a total of 226 agricultural companies of the Beijing Stock Exchange were collected and classified based on the management classification results of listed companies in the National SME Share Transfer System.

Table 1: Descriptive statistics of variables.

Variable	mean	SD	minimum	maximum
IC	-0.181	1.783	-3.110	3.459
GOVNOI	0.015	0.037	0	0.790
GOVOI	0.009	0.255	0	0.457

GOVTR	0.007	0.378	0	0.101
GOVEI	0.017	0.047	0	0.845
Size	22.30	0.891	0	45.680
ROE	0.011	0.045	-1.00	0.671
LEV	0.49	0.300	0.072	0.920
Age	11.45	5.261	4	17
SR	0.039	0.155	-1.231	1.458

4 EMPIRICAL TEST

4.1 Test of the Effect of Government Subsidies and Tax Refund on IC

According to the test results in Table 2, the full samples of government subsidies included in "non-operational income" unrelated to daily operation does not have a significant effect on IC, while government subsidies and tax refunds included in "other income" related to daily operation have a positive effect on IC. Compared with Shanghai and Shenzhen stocks, the effect on the IC of agricultural enterprises listed on the Beijing Stock Exchange is relatively big, perhaps because most companies listed on the Beijing Stock Exchange are small and medium-sized companies whose corporate governance and corporate operation should be improved. In addition, the information disclosure requirements of enterprises listed on the Beijing Stock Exchange are different from those of enterprises listed on the main board. Therefore, investors do not trust agricultural enterprises listed on the Beijing Stock Exchange, which affects the IC. However, the results show that government subsidies can positively increase the IC in agricultural enterprises of the Beijing Stock Exchange, with a greater supporting effect. Secondly, the test results also show that government subsidies unrelated to the operation may not have a supporting effect on investors. Compared with government subsidies unrelated to daily operation, tax refunds and government subsidies related to daily operation included in "other income" have a greater positive effect on IC, that is, to increase IC. Domestic scholars have also found that different classifications of government subsidies have different influences on R&D expenditures, innovation ability, and other aspects of enterprises. Seen from control variables, the profitability, financial leverage, and other aspects of agricultural enterprises have no statistically significant impact, whereas the enterprise size and listing age have a positive impact on IC. Finally, we can see from the test results that the effect of tax refund (with an impact coefficient of 0.0318) is greater than that of the government subsidies included in "other income" related to daily operation (with an impact coefficient of 0.0245), perhaps because agricultural enterprises have certain conditions to meet the requirements for tax refunds with a stronger supporting effect.

Table 2: Regression results of the effect of government subsidies on IC.

Variable	IC	IC	IC
	full	HS	BJ
GOVNOI	0.0031 (0.129)	0.0024 (0.170)	0.0036 (0.137)
GOVOI	0.0276* (0.062)	0.0117** (0.041)	0.0210* (0.077)
GOVTR	0.0325* (0.078)	0.0206* (0.063)	0.0389* (0.066)
Size	0.0012* (0.039)	0.0010* (0.044)	0.0018 (0.109)
ROE	0.0036 (0.901)	0.0054 (0.862)	0.0051 (0.151)
LEV	-0.9290 (0.890)	-1.4456 (1.237)	-1.3786 (0.972)
Age	0.0010* (0.048)	0.0007* (0.044)	0.0020* (0.021)
SR	0.0335* (0.072)	0.0298** (0.083)	0.0451* (0.027)
Individual and Year	Controlled	Controlled	Controlled
Adj. R^2	0.3002	0.3461	0.2217
F	107.15***	110.28***	100.22***
N	1647	1421	226

***, ** and * denote statistical significance at the 1%, 5%, and 10% level.

4.2 Test of the Moderating Effect of State-owned Capital Shareholding

Based on the above test results, we further explored whether state-owned capital shareholding could enhance the supporting effect of government subsidies and tax refunds. The results in Table 3 show that the regression coefficient of GOVNOI×GOVEI is not significant, that of GOVOI×GOVEI is 0.0572 ($\rho < 0.1$), and that of GOVTR×GOVEI is 0.0656 ($\rho < 0.1$) when the interaction terms of state-owned capital shareholding ratio, government subsidies, and tax refund are added in Models 5, 6, and 7. Consistent with the test results in Table 2, the state-owned capital shareholding cannot enhance the influence of non-operational government subsidies . The regression coefficient of the interaction terms of state-owned capital shareholding, government subsidies, and tax refunds related to daily operation is significantly positive, which indicates that a higher proportion of state-owned capital shareholding can enhance the influence of government subsidies and tax refunds related to daily operation on IC. The above-

mentioned results show that state-owned capital shareholding can enhance the supervision of the governance environment of agricultural enterprises, thereby further increasing IC.

Table 3: Test results of the moderating effect of state-owned capital shareholdings.

Variable	Model (5)	Model (6)	Model (7)
	IC	IC	IC
GOVNOI	0.0008 (0.134)		
GOVEI	0.0302* (0.077)		
GOVNOI×GOVEI	0.0405 (0.184)		
GOVOI		0.0334*** (0.004)	
GOVEI		0.0355** (0.085)	
GOVOI×GOVEI		0.0572* (0.090)	
GOVTR			0.0201* (0.089)
GOVEI			0.0142* (0.092)
GOVTR×GOVEI			0.0656* (0.097)
control variable	Yes	Yes	Yes
Adj. R^2	0.3711	0.3223	0.3039
F	27.021***	28.119***	27.458***
N	1647	1647	1647

***, ** and * denote statistical significance at the 1%, 5%, and 10% level.

Some control variables that will affect IC in agricultural enterprises may be omitted in this paper. In order to solve the possible endogeneity problem of the model and perform the robustness test, in this paper, the following methods were used. Firstly, by adjusting the characteristic variables of agricultural enterprises, the debt-to-assets ratio (Debt) and operating profit margin (Margins) were added. Then, the IC index (ICQ) was transformed, and Tobin Q value, turnover rate, and Baidu search index were used for re-fitting. Following that, the dynamic GMM model was used for estimation test. The test results are almost the same to the main research conclusions of this paper.

5 CONCLUSIONS

From the perspective of behavioral finance, this paper develops the IC index by combining big data and traditional indexes. The bearish and bullish expectation index of investors of the Stock Bar, Baidu search index, and stock turnover (STM) were fitted by principal component analysis to extract the common components of IC. Compared with the existing method, this method can measure the IC more timely and comprehensively.

According to the research results, government non-operational subsidies cannot increase IC. Therefore, in order to increase the IC in listed agricultural companies of the market, when giving subsidies to agriculture, the government should make more customized subsidy policies related to daily operation according to the characteristics of agricultural operation. In addition, compared with government subsidies, agricultural listed companies may need to truly operate to receive the tax refunds. Therefore, we can also consider decreasing direct fund subsidies and supporting agricultural enterprises from taxes and dues.

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